RESEARCH ADMINISTRATION
Bureau of Field Services
Michigan Department of Transportation

Research Spotlight

Targeted strategies to extend the life of asphalt pavements

Pavements represent a major investment of MDOT's time, money and resources. Like any highway agency, MDOT keeps a watchful eye on this investment. Pavements should meet or exceed their design life. When they do not, it is important to understand the reasons for premature failure and identify practical methods of extending performance.

Project Information

REPORT NAME: Extending the Life of Asphalt Pavements

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TOTAL COST: $147,008

COST SHARING: 20% MDOT, 80% FHWA through the SPR, Part II, Program

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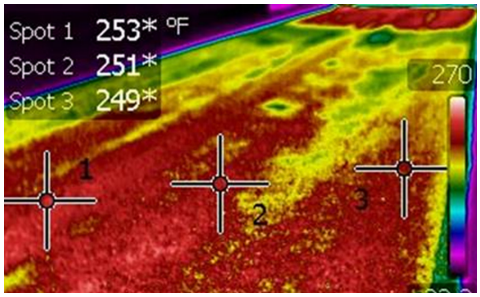
Problem

Not all asphalt pavements perform equally well, but apparent trends in performance and empirical field observations only tell part of the story. To take appropriate steps to extend pavement life—whether through changes in design, construction or maintenance—MDOT needed to use a data-driven approach to understand the most pressing problems related to premature pavement failure and advance strategies that would best address them.

Approach

Researchers set out to answer a number of questions about MDOT's asphalt pavements: How well are these pavements performing? When are Michigan's roads being rehabilitated? What are the driving factors leading to the need to rehabilitate? Most importantly, based on this information, what kinds of mitigating strategies will effectively lead to longer pavement life?

Through a research program assessing MDOT's network of asphalt pavements, researchers examined the agency's pavement management database in an effort to answer these questions.



Mitigation strategies: A longitudinal joint specification could include use of a notched wedge joint (top); targeted inspection with infrared cameras during construction could help identify problematic temperature variations (bottom).

Research

The research included a statistical analysis of MDOT performance indicators (Distress Index, or DI; rut depth; and pavement surface smoothness as measured by the

(continued)

"In addition to identifying the most promising practices to extend the life of hot-mix asphalt pavements, this research also provides recommendations for pilot implementations."

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International Roughness Index, or IRI) that are used by the department to evaluate performance and determine timing of rehabilitation.

Using MDOT's pavement performance management system database, researchers looked at long-term performance by grouping hot-mix asphalt (HMA) surfaced roadways into four pavement structural categories:

- New and reconstructed flexible pavements.
- Crush and shape with HMA surface pavements.
- Mill and resurface flexible pavements.
- Resurface flexible pavements.

The most prevalent distress types were identified for all of the categories. Through analysis of MDOT's pavement management database, researchers also sought to establish the most common and most severe trends in premature aging. Longitudinal cracks, transverse cracks and surface tears were found to have occurred on 100 percent of projects that were part of this research, whereas alligator or block cracking occurred on well over 50 percent of the projects.

Results

Investigators found that among the different measures of pavement performance—rutting, roughness and distress—unacceptable distress levels were most commonly the controlling factor leading to required maintenance. Based on this finding, several mitigation strategies were detailed to reduce pavement distress through possible improvements in design and construction.

- ***Reduce magnitude and severity of distress*** related to longitudinal construction joints by improving and implementing a longitudinal construction joint specification and by improving construction and construction monitoring practices for longitudinal joints.
- ***Conduct biased sampling and testing.*** This approach uses density checks, visual inspection and infrared imaging to identify and correct problem areas within freshly placed mix that relate to paving equipment and construction practices, such as poor and uneven compaction, material and temperature segregation, and inadequate amount of mixture under the paver.
- ***Revise mixture design procedures.*** Specifically, the approach would assess techniques to increase liquid asphalt content by volume, with a desired result of pavements that are less brittle and more resistant to cracking and tearing. More generally, the approach includes an evaluation of fundamental asphalt properties.
- ***Make further use of wearing courses and surfaces with enhanced properties,*** such as stone matrix asphalt and polymer modified asphalt, which have proved successful in Michigan and other locations in the Midwest.

Four demonstration/pilot projects are proposed to test the value and effectiveness of the mitigation strategies identified in the report.

Value

The research confirmed much of what MDOT engineers believed to be true about asphalt pavement performance and trends in pavement distress over time, and it sets forth mitigation strategies accordingly. By presenting strategies as testable pilot programs, this project provides Michigan with a ready means to assess their effectiveness. Such evolution of these strategies is data-driven and consistent with the research approach used to assess the state's asphalt pavements.

The findings of this research also suggest that the mitigation strategies that have been pursued and studied by the department for implementation are on the right track. These include, but are not limited to, developing a longitudinal construction joint specification, looking at the HMA mix design procedure to increase binder content and using thermal imaging infrared cameras in construction monitoring.

Research Administration

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